PATENT
Attorney Docket No. 401442/SAKAI

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

OSAMU NISHIKIDO

Application No. Unknown

Filed: November 6, 2001

For: AM DEMODULATOR

Art Unit: Unknown

Examiner: Unknown

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

Prior to the examination of the above-identified patent application, please enter the following amendments and consider the following remarks.

IN THE SPECIFICATION:

Replace the paragraph beginning at page 4, line 18 with:

In order to prevent such inversion of the detection output, countermeasures are taken by providing means for stopping the PLL control at the time of over-modulation, or means for reducing speed of the PLL control. Because of provision of such means, following of the phase change due to the over-modulation can be prevented. However, with these countermeasures, the APC detection circuit 2 hardly operates at the time of over-modulation, and there arises a problem that stability at the time of over-modulation deteriorates.

IN THE CLAIMS:

Replace the indicated claims with:

1. (Amended) An AM demodulator that receives and demodulates an AM modulated input signal using a wave-detection signal generated by a phase locked loop, said AM demodulator comprising:

a voltage controlled oscillator which outputs a wave-detection signal;

a phase locked loop including

a detection unit which detects whether a detection signal, obtained by AM wave-detection of the wave-detection signal, has a specific relationship with respect to a threshold amplitude level;

a first multiplying unit which raises an AM modulated input signal to a 2n-th power, where n is an integer and at least 1;

a second multiplying unit which raises the wave-detection signal output from said voltage controlled oscillator to the 2n-th power; and

a phase control unit providing phase control using outputs of said first and second multiplying units; and

a switching unit which resets said phase locked loop in response to the detection signal.

2. (Amended) The AM demodulator according to claim 1, further comprising:

a first phase shift unit which generates, based on the AM modulated input signal, two signals that have a phase difference of 90 degrees; and

a second phase shift unit which generates, based on the wave-detection signal output from said voltage controlled oscillator, two signals that have a phase difference of 90 degrees, wherein said first multiplying unit processes the two signals generated by said first phase shift unit, and said second multiplying unit processes the two signals generated by said second phase shift unit.

3. (Amended) An AM demodulator that receives and demodulates an AM modulated input signal using a wave-detection signal generated by a phase locked loop, said AM demodulator comprising:

a voltage controlled oscillator which outputs a wave-detection signal;

a detection unit which detects whether a detection signal, obtained by AM wave-detection of the wave-detection signal, has a specific relationship with respect to a threshold amplitude level;

a first multiplying unit which raises an AM modulated input signal to a 2n-th power, where n is an integer and at least 1;

a second multiplying unit which raises the wave-detection signal output from said voltage controlled oscillator to the 2n-th power;

a first phase control unit providing phase control using outputs of said first and second multiplying units;

a second phase control unit providing phase control using the wave-detection signal output from said voltage controlled oscillator;

a filter unit which generates a signal for controlling said voltage controlled oscillator; and

a selection unit which selects a signal output from one of said first phase control unit and said second phase control unit in response to the detection signal and provides the signal selected to said filter unit.

4. (Amended) The AM demodulator according to claim 3, further comprising:

a first phase shift unit which generates, based on the AM modulated input signal, two signals that have a phase difference of 90 degrees; and

a second phase shift unit which generates, based on the wave-detection signal output from said voltage controlled oscillator, two signals that have a phase difference of 90 degrees, wherein said first multiplying unit processes the two signals generated by said first phase shift unit, and said second multiplying unit processes the two signals generated by said second phase shift unit.

5. (Amended) An AM demodulator that receives and demodulates an AM modulated input signal using a wave-detection signal generated by a phase locked loop, said AM demodulator comprising:

a voltage controlled oscillator which outputs a wave-detection signal;

a detection unit which detects whether a detection signal, obtained by AM wave-detection of the wave-detection signal, has a specific relationship with respect to a threshold amplitude level;

a first multiplying unit which raises an AM modulated input signal to a 2n-th power, where n is an integer and at least 1;

a second multiplying unit which raises the wave-detection signal output from said voltage controlled oscillator to the 2n-th power;

a first phase control unit providing phase control using outputs of said first and second multiplying units;

a second phase control unit providing phase control using the wave-detection signal output from said voltage controlled oscillator;

a filter unit which generates a signal for controlling said voltage controlled oscillator; and

a switching unit which provides a signal output by said second phase control unit to said filter unit in response to the detection signal.

6. (Amended) The AM demodulator according to claim 5, further comprising:

a first phase shift unit which generates, based on the AM modulated input signal, two signals that have a phase difference of 90 degrees; and

a second phase shift unit which generates, based on the wave-detection signal output from said voltage controlled oscillator, two signals that have a phase difference of 90 degrees, wherein said first multiplying unit processes the two signals generated by said first phase shift unit, and said second multiplying unit processes the two signals generated by said second phase shift unit.

IN THE ABSTRACT:

Replace the Abstract with:

ABSTRACT OF THE DISCLOSURE

An AM demodulator includes an APC detection circuit that compares phases of an AM-modulated input signal and a signal output from a VCO. However, the APC detection circuit multiples the two signals before their comparison. As a result, even if the phases of the input signal or the signal output from the VCO is shifted by 180 degrees, the result of comparison by the APC detection circuit is not influenced by the phase shift. Moreover, when a signal detected by the AM detection circuit is in a potential range showing over-modulation, operation of a PLL circuit is stopped.

REMARKS

The foregoing Amendment corrects translational errors and conforms the claims to United States practice. No new matter is added.

Respectfully submitted,

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AMENDMENTS TO SPECIFICATION, CLAIMS AND ABSTRACT MADE VIA PRELIMINARY AMENDMENT

Amendments to the paragraph beginning at page 4, line 18:

In order to prevent such inversion of the detection output, countermeasures are taken by providing means for stopping the PLL control at the time of over-modulation, or means for reducing ~~a~~ speed of the PLL control. Because of provision of such means, ~~the~~ following of the phase change due to the over-modulation can be prevented. However, with these countermeasures, ~~the operation by~~ the APC detection circuit 2 ~~is~~ hardly ~~performed~~ operates at the time of over-modulation, and there arises a problem that stability at the time of over-modulation ~~is deteriorated~~ deteriorates.

Amendments to existing claims:

1. (Amended) An AM demodulator that receives and demodulates an AM modulated input signal using a wave-detection signal generated by a phase ~~lock~~ locked loop, said AM demodulator comprising:

a voltage controlled oscillator which outputs a wave-detection signal;

a phase locked loop including

a detection unit which detects whether ~~the~~ a detection signal ~~when it detects that a signal~~, obtained by AM wave-detection of the wave-detection signal, has a ~~predetermined~~ specific relationship with respect to a ~~predetermined~~ threshold amplitude level;

a first multiplying unit which raises ~~the~~ an AM modulated input signal to a 2n-th power, where n is an integer ~~equal to or greater than~~ and at least 1;

~~a voltage control oscillator which output the wave-detection signal;~~

a second multiplying unit which raises the wave-detection signal output from said voltage~~-control~~ controlled oscillator to the 2n-th power; and

a phase control unit~~-performs a~~ providing phase control using~~-the~~ outputs of said first and second multiplying units; and

a switching unit which resets said phase~~-lock~~ locked loop~~-comprising said detection unit, said first and second multiplying units, and said phase control unit according~~ in response to the detection signal.

2. (Amended) The AM demodulator according to claim 1, further comprising:

a first phase shift unit which generates, based on the AM modulated input signal, two signals that have a phase difference of 90 degrees; and

a second phase shift unit which generates, based on the wave-detection signal output from said voltage~~-control~~ controlled oscillator, two signals that have a phase difference of 90 degrees, wherein said first multiplying unit processes the two signals generated by said first phase shift unit, and said second multiplying unit processes the two signals generated by said second phase shift unit.

3. (Amended) An AM demodulator that receives and demodulates an AM modulated input signal using a wave-detection signal generated by a phase~~-lock~~ locked loop, said AM demodulator comprising:

a voltage controlled oscillator which outputs a wave-detection signal;

a detection unit which detects whether~~-the~~ a detection signal~~-when it detects that a signal~~, obtained by AM wave-detection of the wave-detection signal, has a~~-predetermined~~ specific relationship with respect to a~~-predetermined~~ threshold amplitude level;

a first multiplying unit which raises~~-the~~ an AM modulated input signal to a 2n-th power, where n is an integer~~-equal to or greater than~~ and at least 1;

~~a voltage control oscillator which output the wave-detection signal;~~

a second multiplying unit which raises the wave-detection signal output from said voltage~~-control~~ controlled oscillator to the 2n-th power;

a first phase control unit~~-performs~~ providing phase control using~~-the~~ outputs of said first and second multiplying units;

a second phase control unit~~-performs~~ providing phase control using the wave-detection signal output from said voltage~~-control~~ controlled oscillator;

a filter unit which generates a signal for controlling said voltage~~-control~~ controlled oscillator; and

a selection unit which selects a signal output from~~-either~~ one of said first phase control unit~~-or~~ and said second phase control unit~~-according~~ in response to the detection signal and ~~provided~~ provides the~~-selected~~ signal selected to said filter unit.

4. (Amended) The AM demodulator according to claim 3, further comprising:

a first phase shift unit which generates, based on the AM modulated input signal, two signals that have a phase difference of 90 degrees; and

a second phase shift unit which generates, based on the wave-detection signal output from said voltage~~-control~~ controlled oscillator, two signals that have a phase difference of 90 degrees, wherein said first multiplying unit processes the two signals generated by said first phase shift unit, and said second multiplying unit processes the two signals generated by said second phase shift unit.

5. (Amended) An AM demodulator that receives and demodulates an AM modulated input signal using a wave-detection signal generated by a phase~~-lock~~ locked loop, said AM demodulator comprising:

a voltage controlled oscillator which outputs a wave-detection signal;

a detection unit which detects whether~~-the~~ a detection signal~~-when it detects that a signal~~, obtained by AM wave-detection of the wave-detection signal, has a~~-predetermined~~ specific relationship with respect to a~~-predetermined~~ threshold amplitude level;

a first multiplying unit which raises~~-the~~ an AM modulated input signal to a 2n-th power, where n is an integer~~-equal to or greater than~~ and at least 1;

~~a voltage control oscillator which output the wave-detection signal;~~

a second multiplying unit which raises the wave-detection signal output from said voltage~~-control~~ controlled oscillator to the 2n-th power;

a first phase control unit~~-performs~~ providing phase control using~~-the~~ outputs of said first and second multiplying units;

a second phase control unit~~-performs~~ providing phase control using the wave-detection signal output from said voltage~~-control~~ controlled oscillator;

a filter unit which generates a signal for controlling said voltage~~-control~~ controlled oscillator; and

a switching unit which~~-provided~~ provides a signal output by said second phase control unit to said filter unit~~-according~~ in response to the detection signal.

6. (Amended) The AM demodulator according to claim 5, further comprising:

a first phase shift unit which generates, based on the AM modulated input signal, two signals that have a phase difference of 90 degrees; and

a second phase shift unit which generates, based on the wave-detection signal output from said voltage~~-control~~ controlled oscillator, two signals that have a phase difference of 90 degrees, wherein said first multiplying unit processes the two signals generated by said first

phase shift unit, and said second multiplying unit processes the two signals generated by said second phase shift unit.

Amendments to the abstract:

ABSTRACT OF THE DISCLOSURE

~~The~~An AM demodulator includes ~~the~~ an APC detection circuit that compares phases of ~~the~~ an AM-modulated input signal and ~~the~~ a signal output from a VCO. However, the APC detection circuit multiples the two signals before their comparison. As a result, even if the phases of the input signal or the signal output from the VCO is shifted by 180 degrees, the result of comparison by the APC detection circuit is not influenced ~~due to~~ by the phase shift. Moreover, ~~in the case where~~ when a signal detected by the AM detection circuit is in a ~~predetermined~~ potential range showing over-modulation, ~~an~~ operation of a PLL circuit is ~~rest~~ stopped.

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PENDING CLAIMS AFTER ENTRY OF PRELIMINARY AMENDMENT

1. An AM demodulator that receives and demodulates an AM modulated input signal using a wave-detection signal generated by a phase locked loop, said AM demodulator comprising:

a voltage controlled oscillator which outputs a wave-detection signal;

a phase locked loop including

a detection unit which detects whether a detection signal, obtained by AM wave-detection of the wave-detection signal, has a specific relationship with respect to a threshold amplitude level;

a first multiplying unit which raises an AM modulated input signal to a 2n-th power, where n is an integer and at least 1;

a second multiplying unit which raises the wave-detection signal output from said voltage controlled oscillator to the 2n-th power; and

a phase control unit providing phase control using outputs of said first and second multiplying units; and

a switching unit which resets said phase locked loop in response to the detection signal.

2. The AM demodulator according to claim 1, further comprising:

a first phase shift unit which generates, based on the AM modulated input signal, two signals that have a phase difference of 90 degrees; and

a second phase shift unit which generates, based on the wave-detection signal output from said voltage controlled oscillator, two signals that have a phase difference of 90 degrees, wherein said first multiplying unit processes the two signals generated by said first phase shift unit, and said second multiplying unit processes the two signals generated by said second phase shift unit.

3. An AM demodulator that receives and demodulates an AM modulated input signal using a wave-detection signal generated by a phase locked loop, said AM demodulator comprising:

a voltage controlled oscillator which outputs a wave-detection signal;

a detection unit which detects whether a detection signal, obtained by AM wave-detection of the wave-detection signal, has a specific relationship with respect to a threshold amplitude level;

a first multiplying unit which raises an AM modulated input signal to a 2n-th power, where n is an integer and at least 1;

a second multiplying unit which raises the wave-detection signal output from said voltage controlled oscillator to the 2n-th power;

a first phase control unit providing phase control using outputs of said first and second multiplying units;

a second phase control unit providing phase control using the wave-detection signal output from said voltage controlled oscillator;

a filter unit which generates a signal for controlling said voltage controlled oscillator; and

a selection unit which selects a signal output from one of said first phase control unit and said second phase control unit in response to the detection signal and provides the signal selected to said filter unit.

4. The AM demodulator according to claim 3, further comprising:

a first phase shift unit which generates, based on the AM modulated input signal, two signals that have a phase difference of 90 degrees; and

a second phase shift unit which generates, based on the wave-detection signal output from said voltage controlled oscillator, two signals that have a phase difference of 90 degrees, wherein said first multiplying unit processes the two signals generated by said first phase shift unit, and said second multiplying unit processes the two signals generated by said second phase shift unit.

5. An AM demodulator that receives and demodulates an AM modulated input signal using a wave-detection signal generated by a phase locked loop, said AM demodulator comprising:

a voltage controlled oscillator which outputs a wave-detection signal;

a detection unit which detects whether a detection signal, obtained by AM wave-detection of the wave-detection signal, has a specific relationship with respect to a threshold amplitude level;

a first multiplying unit which raises an AM modulated input signal to a 2n-th power, where n is an integer and at least 1;

a second multiplying unit which raises the wave-detection signal output from said voltage controlled oscillator to the 2n-th power;

a first phase control unit providing phase control using outputs of said first and second multiplying units;

a second phase control unit providing phase control using the wave-detection signal output from said voltage controlled oscillator;

a filter unit which generates a signal for controlling said voltage controlled oscillator; and

a switching unit which provides a signal output by said second phase control unit to said filter unit in response to the detection signal.

6. The AM demodulator according to claim 5, further comprising:

a first phase shift unit which generates, based on the AM modulated input signal, two signals that have a phase difference of 90 degrees; and

a second phase shift unit which generates, based on the wave-detection signal output from said voltage controlled oscillator, two signals that have a phase difference of 90 degrees, wherein said first multiplying unit processes the two signals generated by said first phase shift unit, and said second multiplying unit processes the two signals generated by said second phase shift unit.